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Zetera White Paper on **μSAN™/Microsoft Opportunity**

A paper on the use of the μSAN™ protocol/technology in the "World of Microsoft".

It is assumed that the reader of this paper is familiar with the fundamentals of IP technology. This document is further supported by the detailed Zetera White Paper on μSAN™ technology.

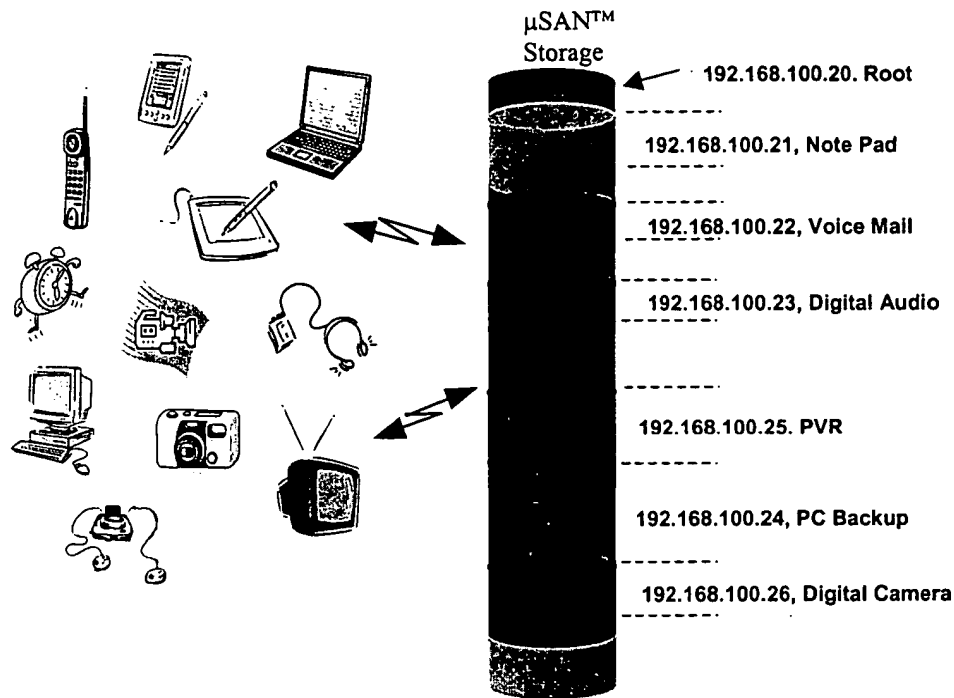
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Author:
Thomas E. Ludwig
VP Engineering, Zetera Corp.

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Overview



This paper introduces the significant advantages that Microsoft would realize through the incorporation of the μSAN™ technology into their various products including:

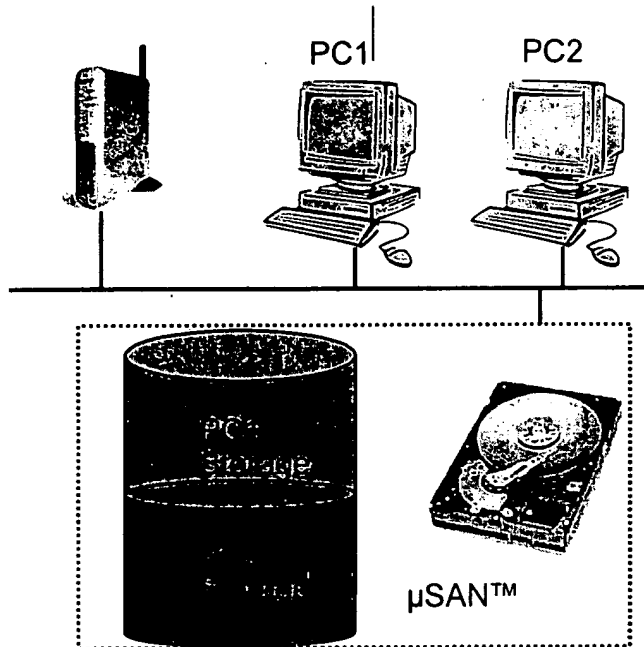
- Windows OS (Server, Client, .Net)
- Consumer Electronics OS (CE) and application software
- Add-on storage to the Xbox
- PVRs and set top media distribution
- Low-cost eHome solutions
- Repository for Windows Media files.
- Storage convergence for computers and appliances

Management of storage and communication has always been the responsibility of the OS. The Zetera μSAN™ technology was developed to set new standards for cost and convenience in networked computers and appliances that are enhanced by storage. These new standards will stimulate new market opportunities that Microsoft is uniquely positioned to exploit within the networked computer and consumer appliance space. The μSAN™ technology brings storage resources to the user at the component level through IP (Internetwork protocol). In doing so, the IP protocol assumes some of the responsibilities that traditionally burdened the OS. This actually simplifies the access and management of storage attached under IP offering significant advantages to the user and opening new markets.

IP is the most widely used communications protocol in the computer world and it is about to become the most widely used protocol in consumer electronics. The advantage of IP is that it is not restricted to any physical bus/protocol. It is fully addressable, routable, virtual and mobile. Consumer electronics by virtue of extensive use of rich entertainment media is becoming a huge user of storage on a scale could eclipse that of the computer. μ SANTM technology brings IP addressable component storage to both consumer electronics and computer systems in an economical, shareable, expandable, redundant and independent method

Zetera believes that μ SANTM is a necessary component in the economic convergence of consumer electronics and computers.

Consider Simple Add-on¹ Computer Storage

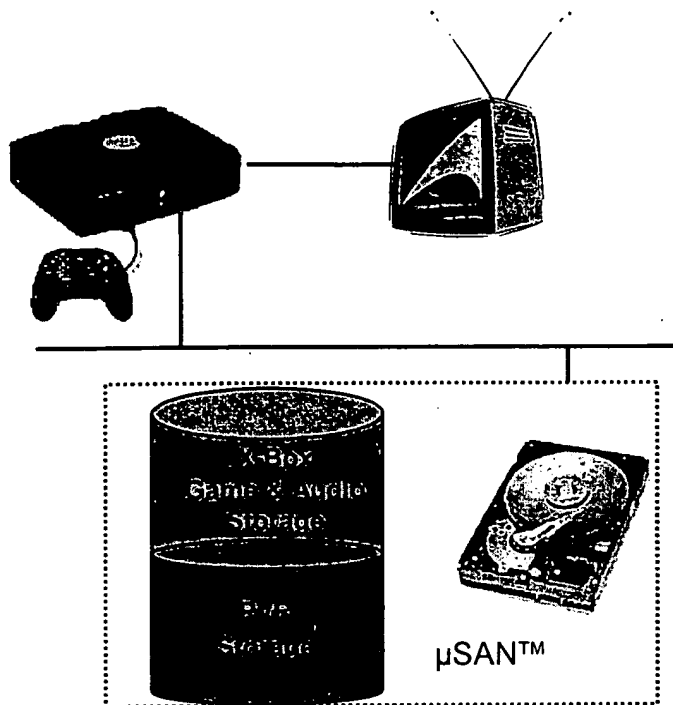


- The physical network is Ethernet, 802.x, HPNA, GbE, ...
- Each PC has a μSAN™ mini-port driver communicating with the IP stack.
- Supports Windows XP, Windows 2000, .Net ...
- No additional IP stack support is required. μSAN™ sits atop UDP or TCP.
- Cost of the stand-alone μSAN™ is similar to USB & 1394 solutions.

The add-on storage solution shown above has significant advantages over direct attached solutions such as USB or 1394. The disk is shared at the network level in a peer-to-peer relationship. The partitioning of the drive is such that each computer perceives that it “owns” its partition exclusively. Indeed, each computer is unaware of the other computers sharing of the drive resource. If the computers wish to share files or folders, they may do so through standard Windows shared resource management. Neither computer must be turned on to support the other’s resources. Spanning and mirroring are supported through multicasting in a seamless manner for simple backup and expansion. Even RAID functions such as striping for performance considerations may be performed. The protocol lives on and improves as physical networks improve in performance, reliability and QoS.

Zeterra believes μSAN™ add-on storage would be an excellent introduction product to Microsoft’s Broadband Networking Group.

Consider Add-on Storage to the X-Box



Xbox, a strong entrant to the video game market delivers the most “bang for the buck” amongst its several competitors. Microsoft made excellent choices for HDD storage and I/O support and these choices favor a μSAN™ solution for expanding storage and features.

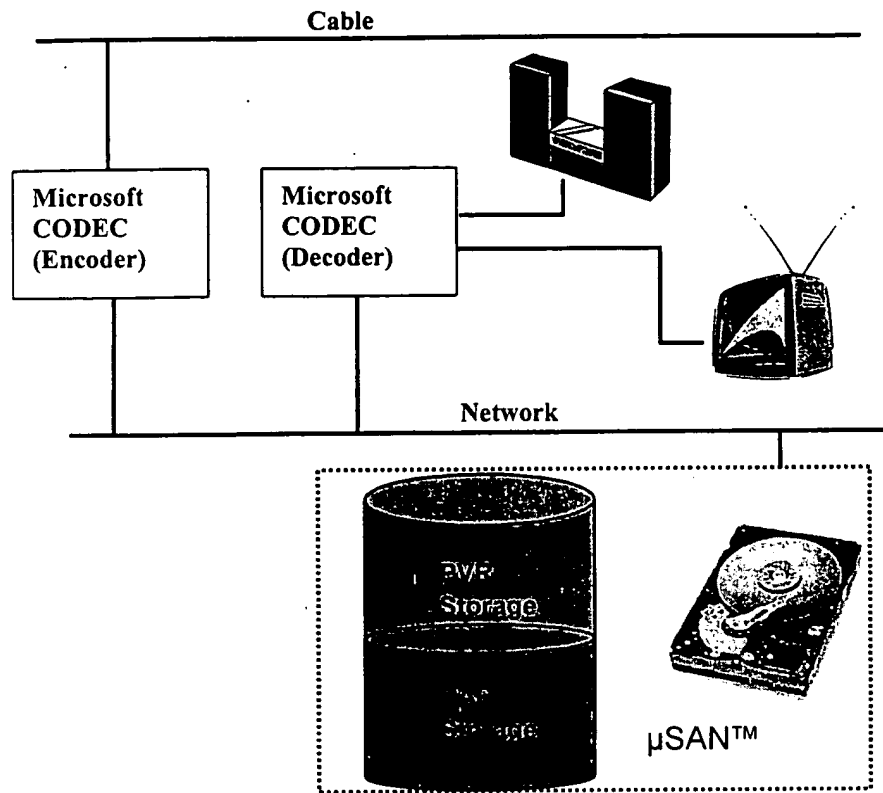
- Cost of HDDs limit the size of on-board storage. (Currently 8 GB)
- The only I/O is Ethernet, USB and A/V.
- The Xbox already has an IP stack. The μSAN™ client would be easy to upload and deploy.

Add-on storage through the Ethernet connection would not restrict availability of the USB connections for user I/O. Additional storage could be used for game or X-Box expansion. Including:

- PC like functionality – The Xbox only lacks the OS and storage to become a PC.
- PVR/PAR functionality. Additional storage would allow the Xbox to behave as a PVR (Personal Video Recorder) or PAR (Personal Audio Recorder) with the addition of the means to input an audio/video stream (either through the USB or Ethernet connection).

The Xbox is well established. Additional storage would mean additional functionality and additional licensing/revenue streams for Microsoft’s Xbox group.

Consider Add-on Storage for Microsoft CODEC & DRM

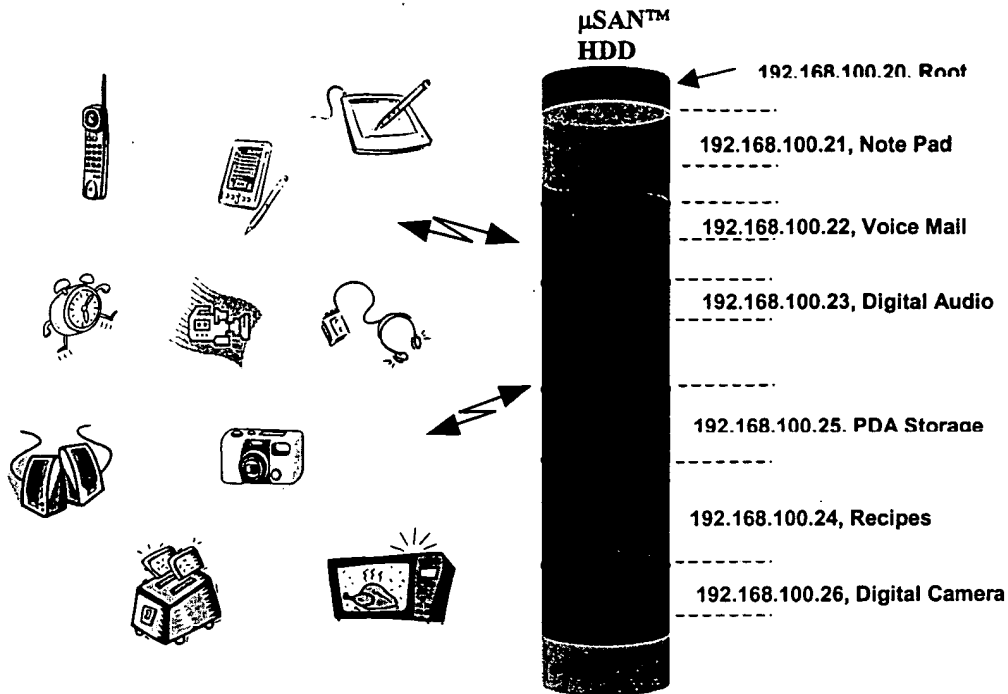


- The Microsoft CODEC may be used in a disaggregated manner to provide encoding of a video or audio signal from many sources including cable.
- This encoded signal is stored on a µSAN™ Partition. The above diagram shows two partitions in use. A PVR (Personal Video Recorder) Partition as well as a PAR (Personal Audio Recorder) Partition.
- The Microsoft CODEC is then used to decode the stored information for playback on a stereo or TV from the appropriate Partition.
- Any imposed DRM (Digital Rights Management) is preserved due to the raw block storage structure.

The simple stack protocol of the µSAN™ provides for addressing of the storage, authentication of packets and confirmation of data transfers. The CODEC simply uses that stack for storage and retrieval. Add more µSAN™ units for more storage. Add more CODECs for picture-in-picture and/or the support of more TV's and stereos for virtual modularity.

The disaggregation of Microsoft's technology such as CODEC & DRM coupled with the disaggregation of storage through the µSAN™ technology will enable new low-cost products and solutions that are economically unattainable with legacy storage solutions.

Consider Simple Consumer Electronics Devices



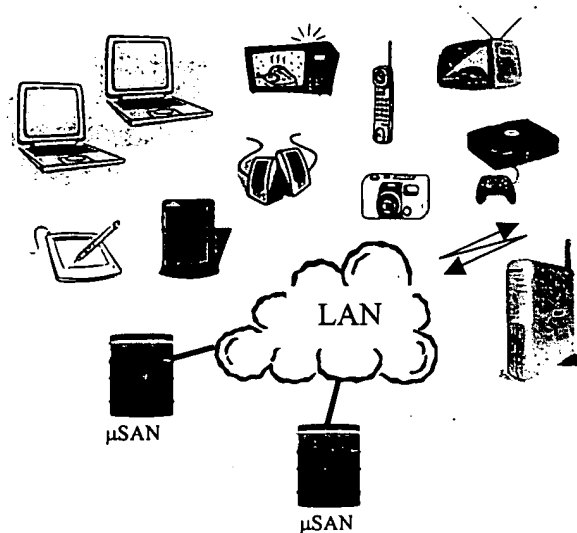
- Price sensitivity prevents dedicated storage choices for this class of devices.
- Major CE manufactures have identified IP as the connection protocol.
- The μSAN™ technology amortizes the storage costs to all of these devices and at a low-cost component level.

Imagine, with costs close to existing products, a new age for consumer electronics:

- Phones with voice mail that is virtually unlimited and routable.
- Notepad computers that are not burdened by the weight/power/mechanical/cost constraints of dedicated HDD storage.
- Digital cameras that automatically download and route the stored images when in range of μSAN™ storage.
- Speakers and headphones that play μSAN™ stored digital audio streams anywhere in the house.
- Microwave ovens and intelligent cooking appliances that can access recipes that are updated continually through the Net.

μSAN™ technology is an excellent opportunity for Microsoft to supply the binding software for this architecture to work together with compatible communication and file structure.

The Big Picture

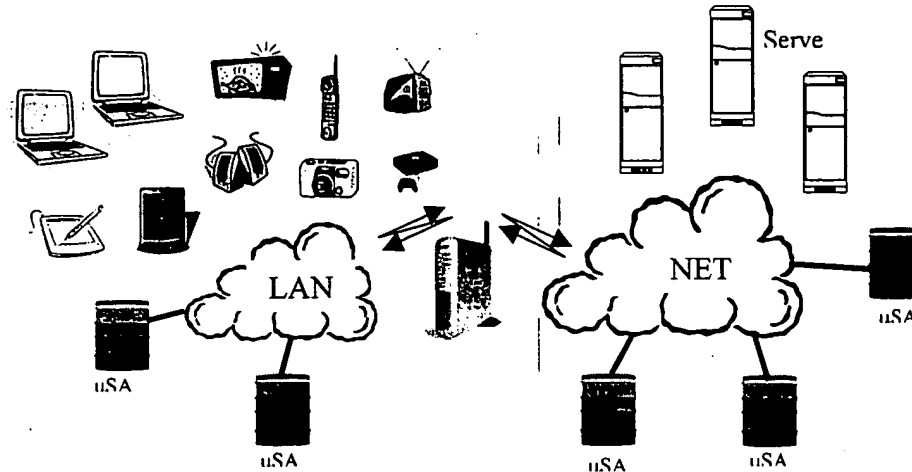


The μ SAN[™] technology easily augments the storage for every IP component in the home or office. It independently supports PC, Notebook and Tablet computers, while at the same time providing storage for appliances from PDAs through toasters. PVRs and PARs easily find upgradeable storage and the Xbox is no longer limited to just 8GB of storage. The μ SAN[™] technology provides storage to each of these devices in such a way that each device is in total control of their storage space just as if it were direct attached.

Imagine bringing home your digital camera and your pictures are saved in IP storage (mirrored IP storage) automatically and where “Grandma” can bring them up on her TV from across the country out of the family album. Your phone rings and through caller ID, an image/background of the caller pops up on your TV in a little window. Or security camera video is stored in easily accessible storage, (easy for the police department to access). By adding IP speakers to your bedroom, you can bring all of your music to where you want it. The opportunity is limited only by imagination and this can all be brought to the consumer/businesses through low-cost solutions with μ SAN[™] and Microsoft technology.

As hard drive capacity increases and \$/GByte decrease, it becomes more apparent that μ SAN[™] technology is the obvious choice to amortize storage and cost among networked computers and appliances.

The Big Big Picture



When all physical storage becomes virtual with the μ SAN™ technology.

Convergence between the computer and consumer electronics becomes a reality when the physical storage for both is accessible through the component level IP storage protocol of μ SAN™. Because of the advantage of seamless spanning, striping and redundancy, Computers, Notebooks and Tablets may be completely diskless or require much smaller local HDDs. Consumer electronics products maintain their price points while gaining in storage and functionality.

Communication for this storage and new functionality is performed through the IP. This is where Microsoft has the opportunity to bring to market a new OS stressing virtual storage and enable new markets that are only achievable with the μ SAN™ technology. Microsoft, through the creation of new appliance communication protocols and storage structures, would enable the convergence business ... a huge business due to the geometric expansion characteristics of communication. There is a unification of CE storage, personal computer storage, server/fabric storage all through the same basic constructs brought in μ SAN™ technology. Imagine bringing home your digital camera and your pictures are saved in IP storage (mirrored IP storage) automatically and where "Grandma" can bring them up on her TV from across the country out of the family album. Your phone rings and through caller ID, an image/backgrounder of the caller pops up on your TV in a little window. Or security camera video is stored in easily accessible storage, (easy for the police department to access). By adding IP speakers to your bedroom, you can bring all of your music to where you want it. The opportunity is limited only by imagination and this can all be brought to the consumer/businesses through low-cost solutions with μ SAN™ and Microsoft technology.

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